

WHAT IS CLAIMED IS:

1. A rotation angle sensing device comprising:
 - a cylindrical magnetic member, which is made of a magnetic material and has a substantially cylindrical shape;
 - a magnetic member, which is disposed inside the cylindrical magnetic member;
 - at least one magnetic sensing element, which is fixed to the magnetic member and detects magnetic force; and
 - at least one main magnet, which is fixed to the cylindrical magnetic member and applies magnetic force to the magnetic sensing element, wherein a relative rotation angle between the cylindrical magnetic member and the magnetic member is detected on the basis of magnetic force detected in the magnetic sensing element,

the rotation angle sensing device further comprising:

 - a supportive magnet, a rotation angle of which relative to the magnetic sensing element is constant; and
 - a magnetic concentration gap, which is formed between the cylindrical magnetic member and the magnetic member, an interval of the magnetic concentration gap becoming smaller in at least one part of the magnetic concentration gap in a predetermined direction.
2. The rotation angle sensing device according to claim 1, wherein:
 - the cylindrical magnetic member is divided in its diametral direction and includes two magnet alignment gaps formed in divided parts thereof, and the main magnet is disposed in each magnet alignment gap;

the magnetic member is divided into at least two portions and has a magnetic detective gap formed in a divided part thereof, and the magnetic sensing element is disposed in the magnetic detective gap; and

the interval of the magnetic concentration gap becomes smaller from each magnet alignment gap toward a central part of each divided portion of the cylindrical magnetic member.

3. The rotation angle sensing device according to claim 1, wherein:

the magnetic force applied to the magnetic sensing element is not vanished by virtue of the supportive magnet when the magnetic force applied to the magnetic sensing element only by the main magnet is vanished; and

the magnetic force applied to the magnetic sensing element is vanished when the magnetic sensing element and the main magnet are relatively rotated so that changed strength of the magnetic force applied to the magnetic sensing element corresponds to strength of the magnetic flux applied to the magnetic sensing element by the supportive magnet.

4. The rotation angle sensing device according to claim 1, wherein maximum strength of the magnetic force applied to the magnetic sensing element by the main magnet is stronger than strength of the magnetic force applied to the magnetic sensing element by the supportive magnet.

5. The rotation angle sensing device according to claim 1, wherein the main magnet and the supportive magnet are permanent magnets having

the same temperature characteristic.

6. The rotation angle sensing device according to claim 1, wherein the supportive magnet is disposed closely to the magnetic sensing element.

7. The rotation angle sensing device according to claim 1, wherein the supportive magnet applies magnetic force to the main magnet.

8. The rotation angle sensing device according to claim 1, wherein the supportive magnet forms magnetic field that is symmetrical with respect to a relative rotation axis between the magnetic sensing element and the main magnet.

9. The rotation angle sensing device according to claim 1, wherein the supportive magnet is disposed on an end of the magnetic member in its axial direction.

10. The rotation angle sensing device according to claim 1, wherein the supportive magnet is disposed outside of the cylindrical magnetic member.